International Journal of Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2022; 5(3): 60-62
Received: 28-04-2022
Accepted: 10-06-2022

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The clinical utilization of Neuroimaging methods in the management of glioblastoma: A review

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DOI: http://dx.doi.org/10.33545/26644436.2022.v5.i3a.277

Abstract
Glioblastomas (GBM) are the most commonly occurring primary brain tumor in adults. They account for the most years of life lost amongst all the intracranial neoplasia occurring in adulthood. GBMs are characterized by brain tissue invasions. Although a lot of research has been going on, not much has change in patient outcome. Researches in neuroimaging modalities have been at the forefront of the drive to better understand, assess and help in management of this neuro-oncological patients with glioblastomas. Some advances have been recorded over the years and also, some initially practiced modalities, withdrawn. This study aims to understand the breakthroughs that have been recorded and the barriers faced in GBM neuroimaging researches around the world and the clinical adoptions of this modalities.

Keywords: Glioblastomas (GBM), Neuroimaging, glioblastomas, pituitary adenomas, meningiomas

Introduction
The Monro-Kelly's doctrine explained that an alteration in any of the three main components of the human skull will lead to change in intracranial pressure and hence, neurological symptoms of these components, the brain may be the culprit when there is an oedema or a brain tumour. Brain Tumours may be primary or secondary in nature, if they were to arise directly from within the brain tissue or from distant metastasis, respectively. Primary brain neoplasms account for over 50% of these. Over two thirds and one third of these occur in the supratentorial and infratentorial regions in adults and children, respectively. About 95% of all brain tumour are accounted for by gliomas, metastases, meningiomas, pituitary adenomas and acoustic neuromas [Bruce ML, *et al*. 2021] [2, 6].
Brain tumour may initially be asymptomatic then symptoms arise based on the area of the brain they are located at. But this may not always be so, as the pressure symptoms from the space occupying lesions may also produce some other symptoms from regions affected. Symptomatology may not necessarily be directly proportional to the size of the tumor, but rather the location of the brain it is located. Hence, the importance of tumour location assessment in the initial stages of management of patients [Herholz K, *et al*. 2012] [12]. Usually in the general assessment of neoplasia, biomarkers and specific stains to help mark the tumors are used [Staedtke V, *et al*. 2016] [21]. However, in the case of intracranial tumours, some of these tumour may be located at areas that are not in contact with the blood system, due to the blood brain barriers (BBB), by the time there is a BB breach, it is invariably correlated with metastasis [Herholz K, *et al*. 2012] [12]. So, is there a way to detect these tumours and a possibility of malignancy before metastatic ensues?.
However, it is important to note that some tumour types may not become malignant, such as neurinomas and meningiomas, but gliomas, especially at stage 4 (according to the WHO grading system), will always be malignant [Kleihues P, *et al*. 2002] [13].
Gliomas are basically tumours that arise from glia cells. Grade 1 gliomas are very rare occur in childhood. Grade 2 gliomas (with subtypes astrocytoma and oligodendroglioma) can be found occurring in all age groups, with a peak in early adulthood. Furthermore, they show little cellular atypia and proliferation, but frequently infiltrate healthy surrounding brain, and, therefore hope of a cure via surgery or radiotherapy is seldom possible.

They are a significant chronic medical problem and confer large uncertainties with regard to therapeutic decisions, which need to balance the imperative of saving intact functioning brain while trying to prevent those tumors from progression. More so, the Grade 3 gliomas are more malignant and are anaplastic. However, when they have a gross cellular atypia and necroses, it is characteristic of glioblastomas that is Grade 4 [Herholz K, *et al*. 2012] [12] [Kleihues P, *et al*. 2002] [13].

Discussion

Now, Glioblastomas (GBM) are the most commonly occurring primary brain tumours in adulthood. They account for more than 50% of these [Bauer S, *et al*. 2013] [4]. They are characterized by invasion into other brain tissues [Hambardzumyan D, *et al*. 2015] [11]. A 5-year study carried out in England between 2007 and 2011 gave the prevalence of recorded cases to be as high as 10, [Brodbelt A, *et al*. 2015] [1, 5]. However, the prognoses for these patients are not improving, as they have an average survival time of about 14 months [Van Meir E, *et al*. 2010] [15] [Delgado-Lopez P, *et al*. 2016] [9]. The most common cause of treatment failure is a local reoccurrence. Hence, the untreated and treated glioblastomas classification. As local recurrence can take route from scars of previous treated lesions, radiological or surgical interventions. In fact, glioblastomas account for the most years of life lost than per patient than any other commonly prevalent adult cancers [Burnet N, *et al*. 2005] [7]. Hence, with such poor statistics, in addition to the pathologic burden of the disease, they undergo varying degrees of psychological disturbances, ranging from depression to anxiety problems especially amongst early diagnosed patients. This is due to the uncertainty and unpredictable outcomes of their prognosis, amongst other causes [Pranckeviciene A, *et al*. 2015] [16] [Renovanz M, *et al*. 2019] [18] [Liu F, *et al*. 2018] [14]. Hence, the need to concurrently assess the quality of life (QoL) of these patients being managed [Fernandez-Mendez R, *et al*. 2019] [10].

Due to this multi-pathological paraneoplastic impact of glioblastomas (GBM), the management are often multidisciplinary, involving both supportive, palliative and focused therapeutic care. Clinicians are still hoping and researchers, searching for better therapies (surgery and radiotherapy) to improve the outcomes of patients and things to exclude from previously practiced therapy with more evidence of improvement [Rahmat R, *et al*. 2020] [17] [Sage W, *et al*. 2018] [19].

Conclusion

Some advancements have been recorded in the utilization of radiologically assisted measure to improve visualization, assessment and treatments of GBMs, such as; the multi-scale segmentation of GBM using diffusion tensor imaging, the use of multimodal magnetic resonance imaging (MRI) to identify perfusion and metabolic changes in the invasive margin of glioblastomas and better understanding into the heterogeneity of glioblastomas [Li C, *et al*. 2018]. Some recordable progresses have also been made in the fields of contrast radiological neuroimaging modalities [Staedtke V, *et al*. 2016] [21]. These, alongside the barriers faced in their development and clinical adoption will dictate the pace at which the world accelerates towards some form of reprieve. With so great a burden of disease, YLL and paraneoplastic burden on the patients with GBM, it is imperative that advancements in current treatment trend be adopted in to clinical managements. With the search for a cure ever being the goal. But a single important question is, where is the world now? To answer this question, it is imperative to assess how far the research, clinical developments and adoption of advanced neuroimaging and radiological techniques have progressed in their journey. Hence, there is a need for future studies to study the breakthroughs and barriers to clinical utilization of advanced neuroimaging methods in the management of glioblastomas.

Conflict of Interest

The Author's declares no conflict of interest.

Acknowledgement

To Prof. Ekene John Ekedigwe, Prof. Musa Dankyau and Dr. Patricia Eseigbe; I am forever grateful. And to Prof. Dr-Med. Oseni-Momodu, who always believed I could fly, though he never stopped to check if I had wings, thank you for more than I can say (OTOBO DD, MD).

The Author's express their deepest gratitude to God, their teachers, mentors and Family.

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